H17 CDM/JI Feasibility Study Outline of Research Report

Research Title 『Indonesia・High Quality Fuelisation of Waste Biomass and its Advanced Utilisation』

Name of Party Ishikawajima-Harima Heavy Industries Co., Ltd.

（1）Basic element of Project Activity

① Outline and Background of Proposed Project

Many of Empty Fruit Bunch (EFB) is wasted from the palm oil process in the mill. The CDM project is the work activity of carbonising of EFB and of utilising of produced carbonised fuel in cement factory. EFB carbonised fuel is renewable fuel and can be handled as CO2 free. The project feature is applying the carbonising process for upgrading of low grade biomass to high quality fuel. This process can link with two different business parties and improve this business profitability. Furthermore the applying carbonising process can reduce CH4 emissions from the left waste EFB, which were anaerobic digested.

The existing treatment manners are “Incineration” and “Leaving on field”. Due to their high moisture contents, it is difficult to complete burning even in the incinerators and the particulates emits to the environment. The spoiled EFB exhales CH4 and nasty smell. EFB is absolutely wastes from the palm oil mill. Palm oil is one of main commercial goods in Indonesia, so the palm oil industry will be developed continuously. It can be expected that the waste EFB amount will also increase more and more. The combining “Discharge of waste Biomass” and “Utilisation” can be achieved by applying Japanese carbonising technology. This is the background of planning this project.

② General of Host country

Indonesia is a country governed by a presidency, with a population of 215 million inhabitants, which consists of 30 provinces extending from Aceh in western part of North Sumatra to Merauke in the eastern part of West Papua (CDM country guide fro Indonesia, IGES 2006). The yearly production amount of Crude Palm Oil is second largest in the world. The leading country is Malaysia, however Malaysia cannot be expected to expand in the future due to the limitation of plantation area. Thus generally speaking Indonesia will be lead the crude palm oil industry in the world. South Sumatra area is located right on the equator and the plantation is continuously expanding.

The potential side is shown in the map below.

PT. AMP Plantation

PT. Semen Padang

③ CDM/JI Criteria at Host country, DNA establish condition, National policy of CDM/JI

Indonesian work on record of Kyoto protocol / Counter measure for Global warming

・Aug/1994 : ratify IPCC as non-annex I country

・1996 : Start AIJ. Achieve 9 projects by 2001 including Japanese 3 activities（NEDO 2 activities, JICA 1 activity）.

・Jul/1998 : sign the Kyoto protocol

・Jun/2002 : setting up the energy sector CDM national team by Minister of Energy and mineral resources

・Sep/2002 : 2 geothermal power generation projects has been approved as CDM projects by the Minister of environment

In Feb/2006, the German proposed project, Solar cooker project has been approved as first official CDM project in Indonesia. By April 2006, 5 CDM projects in Indonesia have been approved by Indonesian DNA.

Mr. Fujistuka (JICA specialist) arranged a meeting, we had a chance and explain our project to Deputy minister of environment.

④ Sustainable development and technology transfer

Indonesia produces energy sources, but the high quality energy sources such as bituminous coal, LNG and heavy fuel oil are exported to obtain the foreign currency. Domestically low quality fossil fuel must be utilised and the energy supply is not enough for the demand. Thus Indonesian government would like to use Renewable energy including Biomass and established a policy shows that 5% of total energy consumption must be covered by Renewable energy by 2020. This target value maybe increased in the future.

The technology used for this project is the carbonization technology, which is mature in the world including Japan. In Japan, there are many commercial plants operating for reduction of city waste. The carbonization technology itself is similar to production of charcoal. In the non-Annex-I countries such as Indonesia, simple structures with a space formed by bricks and one chimney stack are widely used. However, such carbonization furnaces often emit volatile gas components produced in the carbonization process. The major components of the volatile gases are carbon monoxide, hydrogen, and methane, which have harmful effects on the environment and may result in global warming. This project will eliminate GHG emission in the carbonization process by using the kiln-type carbonization technology to separate the volatilization process and volatile gas component combustion process and achieve energy independence by controlling the retention time of the raw materials for carbonization in the kiln.

The technologies to utilize EFBs other than the carbonization furnace include composting and utilization for direct power generation. For composting, there is not sufficient demand for it that requires processing and use of the entire amount of wasted EFBs. In addition, methane gas is produced in anaerobic fermentation in the composting process. The fluidized bed boiler technology can be used to generate power using EFBs directly as fuels. However, only a combustion experiment in an experimental plant in a limited period has been done, and it is known that the high ash adherability due to K content of 30% or more in the EFB ash aggregates the fluid sand and inhibit the flow, which makes it hard to operate continuously. Therefore, the technology is hardly a proven technology.

The characteristics of ECF, EFB carbonized fuel, are equivalent to those of coal, and its grindability is better than coal, so there are a few technological problems in use in the cement manufacturing process. ECF will be mixed with coal or powdered coal and fed into the kiln.

Technology transfer

Indonesia's equipment and technologies for carbonisation of biomass including EFB involves feeding raw material biomass into a small space formed by bricks and carbonising it in partial combustion. This method has no movable part, and manufacturing and operation of the equipment is easy. However, partial combustion and carbonisation process are difficult to control, and there are problems such as emission of pyrolysis gases (including methane) due to imperfect combustion into the air and unstable characteristics of the carbide.

For the kiln type carbonisation furnace adopted in this project, transfer of technologies and expertises is mandatory. The materials and parts comprising the carbonisation furnace can be procured in Indonesia, except for clad steel, although it depends on the degree of automation of operation of the carbonisation furnace. Clad steel can be procured overseas if not possible in Indonesia.

⑤ Organisation of FS

・Planned Site for proposed project

a. PT. AMP PLANTATION：planned area for the Carbonising plant, information of energy and mass balance in Palm Oil Mill, etc.

b. PT. SEMEN PADANG：planned are for CDM project, information of energy and mass balance in Cement manufacturing factory, etc.

・PDD preparation

c. YBUL（Yayasan Bina Usaha Lingkungan）：arrangement of the stakeholder meeting

d. Andaras University：experiments of EFB landfill, research of energy and industry condition in

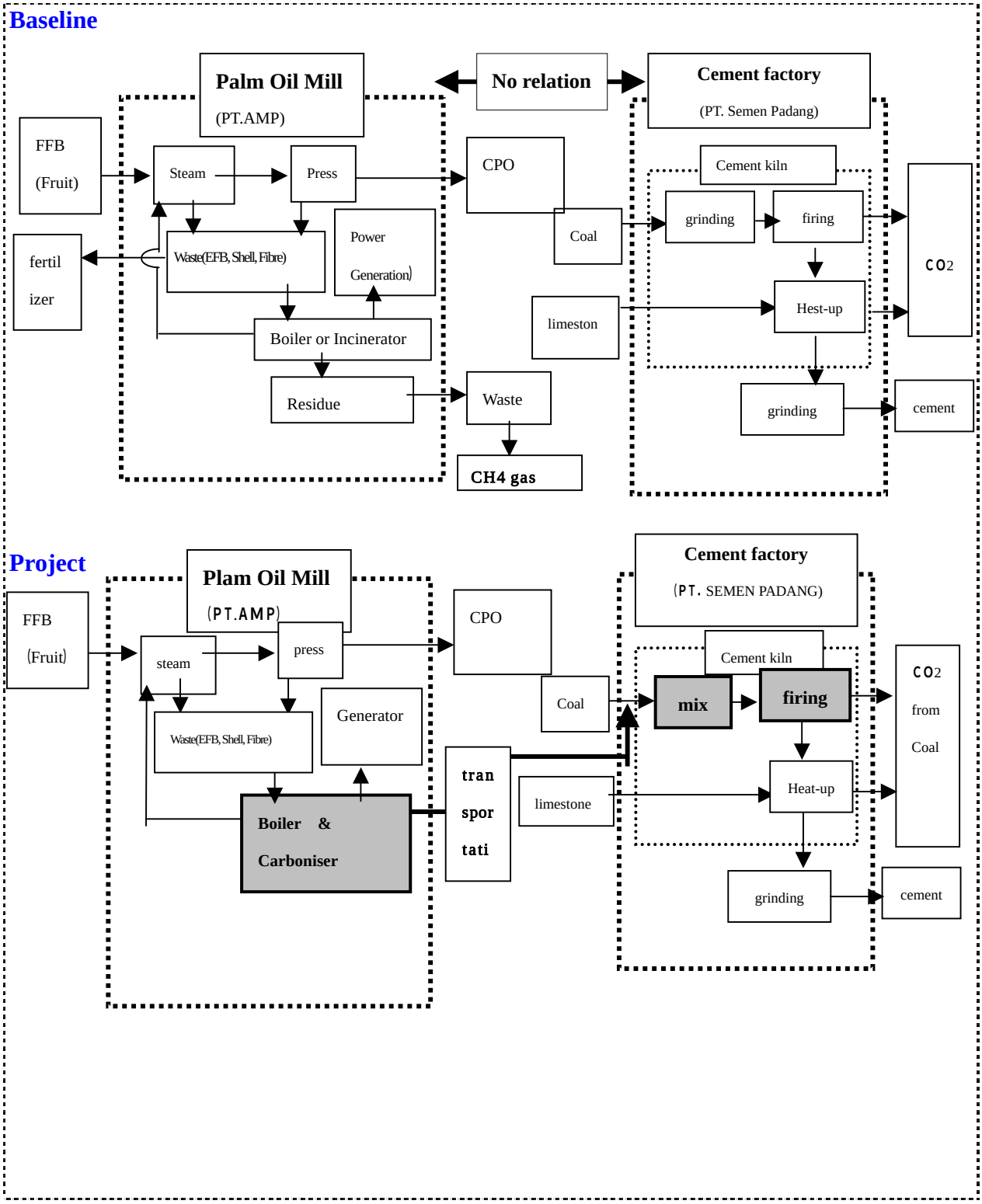
Padang

e. ITB (Institute of Technology Bandung)：Indonesian Biomass potential, collecting CDM information

（2） Project Planning

① Project activity

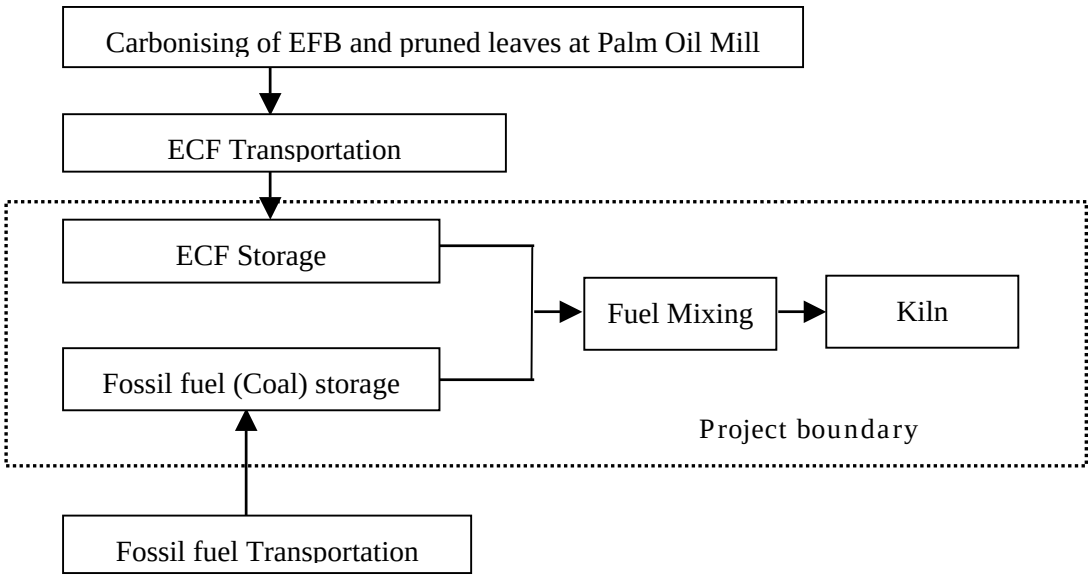
The planned scheme is shown in below. The feature of this project is “linkage between two independent industries”.


Baseline
Palm Oil Mill
(PT.AMP)
No relation
Cement factory
(PT. Semen Padang)
FFB
(Fruit)
Steam
Press
CPO
Cement kiln
grinding
firing
CO2
fertil
izer
Waste(EFB, Shell, Fibre)
Power
Generation)
Coal
Hest-up
limeston
Boiler or Incinerator
Residue
Waste
grinding
cement
CH4 gas
Project
Plam Oil Mill
(PT.AMP)
Cement factory
(PT. SEMEN PADANG)
FFB
(Fruit)
steam
press
CPO
Cement kiln
CO2
from
Coal
Coal
mix
firing
Generator
Waste(EFB, Shell, Fibre)
tran
spor
tati
limestone
Heat-up
Boiler &
Carboniser
grinding
cement

② Project boundary, Baseline and additionality

a. Project boundary

In this project, CDM combines the generator of EFB and consumer of the carbonised fuel. Manufacturing of the carbonised fuel is treated as pre-processing for alternative fuels for coal, and the project boundary is the cement factory. The schematic is shown below.



This project considers ECF co-combustion with coal in the kiln. Amount of ECF and coal used will be recorded and emissions will be calculated according to the approved methodology.

In the carbonisation process of EFB, fuels and electric power are consumed upon start-up of the plant, and GHG is emitted in the transportation process of ECF and coal. These elements are outside of the project boundary, which only includes mixing of ECF and coal and combustion in the kiln.

b. Baseline

Without implementation of this project, EFB will be incinerated or piled outdoors, and a large amount of coal consumed in the cement factory as it is

c. Additionality

The barrier analyses were done with both Baseline activity and project activity. Based on the following results, the proposed activity has an additionality.

(1) Investment barrier:

The proposed project is not economically attractive without additional contribution from CDM. If there is no revenue from CER, the project IRR for 10 years is negative, -4.51%. It is -0.23% even when USD5.0/ton-CO2 is taken into consideration, indicating existence of an investigation barrier.
To examine investigation effects in an abbreviated manner, only the EFB carbonization project is taken into account. That is, it is assumed that the carbonization business receives EFBs from the palm oil mill, carbonizes them, and sells the resulting fuel to the cement manufacturer.

	Scenario 1	Scenario 3	Scenario 3
CER credit	N/A	exclude	include
Investment	N/A	USD 8.6 million	USD 8.6 million
Project life time	N/A	10 years	10 years
Project IRR	N/A	-4.5%	-0.23 %

(b) Technological barrier:
Because the characteristics of the carbonised fuel are equivalent to those of coal, there is no technological barrier in mixed combustion with coal in the cement kiln. The carbonisation technology to manufacture the carbonised fuel from EFB itself is a proven technology as carbonisation of waste in Japan, but the technology to change biomass into carbonised fuels stably without inputting external heat energy may have experimental aspects.

(c) Barrier due to prevailing practice:
This project, inputting biomass carbonised fuels to the cement kiln as a substitute for coal, is the first trial of its kind, not limited to Indonesia. No other enterprises have knowledge about manufacturing of carbonised fuels and inputting them into the cement kiln.

③ GHG reduction of project activity and Leakage

GHG reduction of project activity is CO2 emission from alternative biomass fuel burning. The amount is estimated 45,000 ton-CO2/year. GHG amounts of leakage are (1)GHG emissions from fossil fuel consumption for Carbonising plant operation, (2) CH4 emissions(reduction) due to decay of EFB piled outdoors, (3) GHG emissions from fuel transportation. Total expected amount of GHG reduction is 53,000 ton-CO2e/year

④ Monitoring plan
The project meets the criteria of the approved monitoring methodology : ACM0003, “Emissions reduction through partial substitution of fossil fuels with alternative fuels in cement manufacturing”. The following items will be monitored.

・Clinker production amount
・Consumed amount of EFB Carbonised Fuel
・Amount of consumed coal
・Heating value of EFB Carbonised Fuel
・Heating value of Coal
・Carbon content of EFB Carbonised Fuel
・Carbon content of Coal
・Off-site use of transport fuel
・Fuel oil use for start-up of carbonising plant
・Grid CEF
・Electricity consumption for carbonising plant operation

⑤ Environmental Impact, other in-direct impact

In the current system of the palm oil mill, wasted EFB are incinerated by the 4 incinerators, and the exhaust gas is emitted directly into the air from the chimney stack located at the top of the incinerator made from bricks. The incinerators are the fixed-bed type, and EFB are continuously dropped from the top of the furnace. The air for combustion is supplied via natural convection from the opening of the fender of the fixed bed. This method results in imperfect combustion, emitting carbon monoxide (CO), hydrogen (H), and methane (CH4). In addition, soot and fine particles are also directly emitted to the air. When the smoke emitted from the chimney stack is observed, black smoke is emitted periodically. This situation results in particulate substance contamination of rain water used by the local residents as drinking water.

As production of crude palm oil (CPO) increases year by year, production of waste EFB also increases, and the capacity of the current facilities is getting insufficient. The overflow EFB are not incinerated, and piled outdoors in the premises of the palm oil mill. The EFB piled outdoors quickly decay under the high-temperature and humidity environment of Indonesia. Inside the pile of EFB, oxygen in the air is consumed by decaying and an anaerobic environment occurs, where methane (CH4) produced in anaerobic fermentation is emitted.

For the current situation described above, EFB carbonisation of this project will reduce the EFB piled outdoors, resulting in reduction of fermentation methane (CH4) emission due to decay. Also, the pyrolysis gas combustion furnace and bug filter will be installed in the carbonisation process to reduce emission of CO, CH4, and fine particles due to imperfect combustion.

On the other hand, in the cement factory that consumes coal in the cement kiln, part of the coal will be replaced with the carbonised fuel, reducing carbon dioxide (CO2) emission from coal.

⑥ Stakeholder comments

The project boundary is cement production activity in the PT. Semen Padang

Stakeholder Meeting in PT. AMP Plantation

An invitation letter is sent from the PT. AMP Plantation to the persons listed below, and a meeting was held on December 7, 2005 in a meeting room of the PT. AMP Plantation.

1. The local government authority represented
    - Environmental Protection Agency of West Sumatra Province
    - City Government of Agam Region
    - Head of Agam Sub-District
    - Head of Jorong - Kandis Village
2. Informal Community Leaders and local community
3. NGO

There are some comments related with the particulate emissions from current operation of PT. AMP Plantation. The project activity can reduce the particulate emissions because the carbonising plant has a bag-filter to remove particles.

The meeting was successfully finalised. The confirmation document, which shows the stakeholder meeting was held was signed both local leader (head of village) and PT. AMP Plantation.

Stakeholder Meeting in PT. Semen Padang

An invitation letter is sent from the PT. Semen Padang to the persons listed below, and a meeting was held on February 9, 2006 in a meeting room of Bumi Minang Hotel in Pedang.

1. The local government authority represented
    - Environmental Protection Agency of West Sumatra Province
    - Environmental Protection Agency of Padang City
    - Representative of Padang Mayor
    - Representative of Padang National Land Bureau
    - Representative of Department of Industry, Energy and Mining
    - Head of Indarung Sub-District
    - Head of Indarung Village, Lubuk Kilangan District
2. Informal Community Leaders and local community
3. Academician (Andalas University)

4. Journalists (local newspaper and national newspaper)

There is only one worry opinion. It was said that the project activity may decrease the working opportunity. Actually the replaced amount of coal is only about 5% and it produce the additional work opportunity related with of the operation of the carbonising plant and the transportation of EFB carbonising fuel.
The meeting was successfully finalised. The confirmation document, which shows the stakeholder meeting was held was signed both local leader (head of village) and PT. Semen Padang.

（3）For business activity

① Organisation for Project Activity (domestic, Host country, others)

The operational company will be SPC (Special Purpose Company) invested from Japan side. The Carbonising plant will be installed at the Palm Oil Mill. Indonesian parties will participant in this project from the FS stage. And if they want, they can join the SPC operation.
SPC will install the Carbonising plant and receive EFB from Palm Oil Mill. Excess steam and electricity will be sold to the palm oil mill. And the carbonised fuel will be transport and sold to the cement factory. SPC must agree with the cement factory about CER handling.

② Financial plan for project activity

Total business fund is planned about 8.6 million USD, and its most of parts is the plant cost. It is expected that 50-60% of total cost is covered by Japanese governmental support fund and the remaining parts is coming from the private companies.

③ Cost and Effect

The expected CERs is 0.27 million ton-CO2 fro 5 years operation and equal to 1.3 million USD in case of 5USD/ton-CO2. Furthermore the sales of selling Carbonised fuel can be 4.2 million USD. Investment from private sector can be recovered within 5 years. The above case is based on that the plant will be made in Japan. Second or later units will be fabricated in Indonesia local, the plant cost can be reduced.

④ Expectation and problem for actual business

The major subjects are,

・Evaluate the accurate business and plant costs
・Investment design
・Approval by Host country as CDM project

From the technology point of view, there are no problems, because IHI has a lot of experiences

such a plant construction works. However the business and plant cost must be carefully evaluated for continuous operation. Though these evaluations are not yet done at this feasibility study, the basic design components and equipment specifications are already fixed.

At this moment, there is no plan of investment. However it may easy to find the investors for this proposed project. Because the private companies are probably going to be put under an GHG reduction and they will keen to do some CDM projects or purchase CERs. Of course IHI is investigating own investment to this projects.

As mentioned above, Indonesian CDM approval procedure has been established. It can be easy to obtain the approval if the project will give some advantages to Indonesia such a financial profit, a growth of industries and so on.

The proposed project has highly possibility to achieve the activity as a CDM project.